>>>OPERATORS MANUAL

ICI ARTIFICIAL LIFT

ICI
ARTIFICIAL LIFT

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>>>ICI ARTIFICIAL LIFT INC. >>>BOX 21027, LLOYDMINSTER, ALBERTA, T9V 2S1 >>>WWW.ICISOLUTIONS.CA >>>(780) 872-7470

INTRODUCTION

ICI designs and manufactures a suite of patented artificial lift technologies designed for the production of:

(1) Heavy oil
(2) Light-Medium Crude
(3) Natural Gas (dewatering)
(4) Shallow Gas/Coal Bed Methane (dewatering)
(5) Subsurface Bitumen Recovery

ICI's products can be categorized in three main series:

(1) THE COPPERHEAD 10 SERIES:

A rod pumping hydraulic pump jack with a 14,000lb lift capacity designed for the production of shallow gas/coal bed methane and light production oil wells. This jack replaces the conventional "rod and beam" 114's, 80's and anything below.

(2) THE GOLDEN ROD 20 SERIES:

A rod pumping hydraulic pump jack with a 30,000lb lift capacity designed for the production of light-medium crude and natural gas dewatering (lifting fluid off of liquid loaded gas wells). This jack replaces any conventional "rod and beam" 456's, 320's, 228's and anything below. With a high lift capacity and a stroke length that can be changed from 0" to 120", one Golden Rod jack can replace a 320-256-120 or a 320-213-86 or a 228-213-86 etc.

(3) THE GOLDEN ROD 30 SERIES:

A tubing pumping hydraulic pump jack with a 40,000lb lift capacity designed for heavy oil and high sand/debris content wells. This jack reciprocates the entire tubing string (no sucker rods) to work a large bore downhole tubing pump, producing wells with low gravity, highly viscous oils with very high sand cuts.

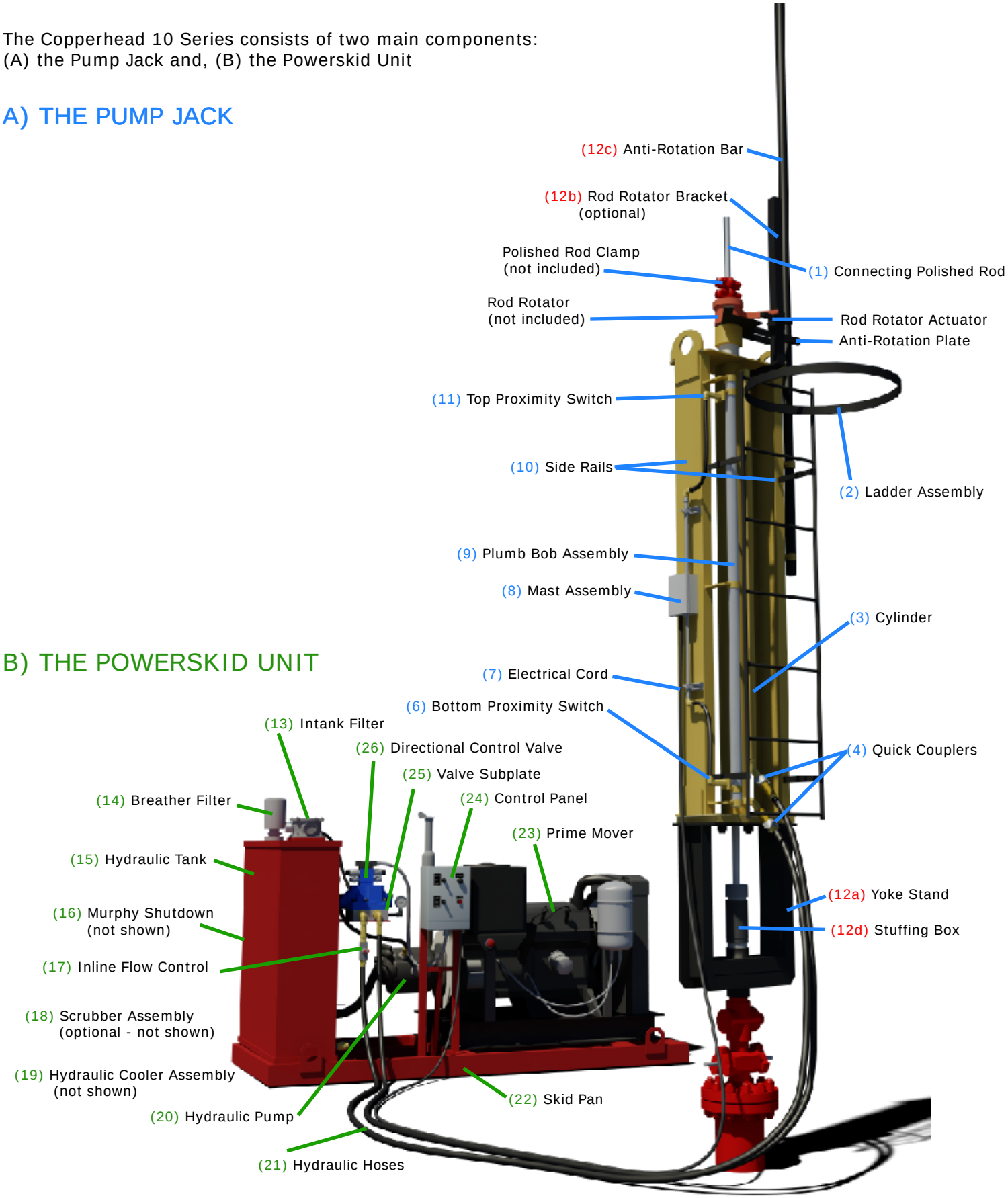
GR-30 Series CH-10 Series GR-20 Series

Each Series consists of two main components: (1) The Pumpjack and (2) The Powerskid Unit

The Copperhead 10 Series consists of two main components:
(A) the Pump Jack and, (B) the Powerskid Unit

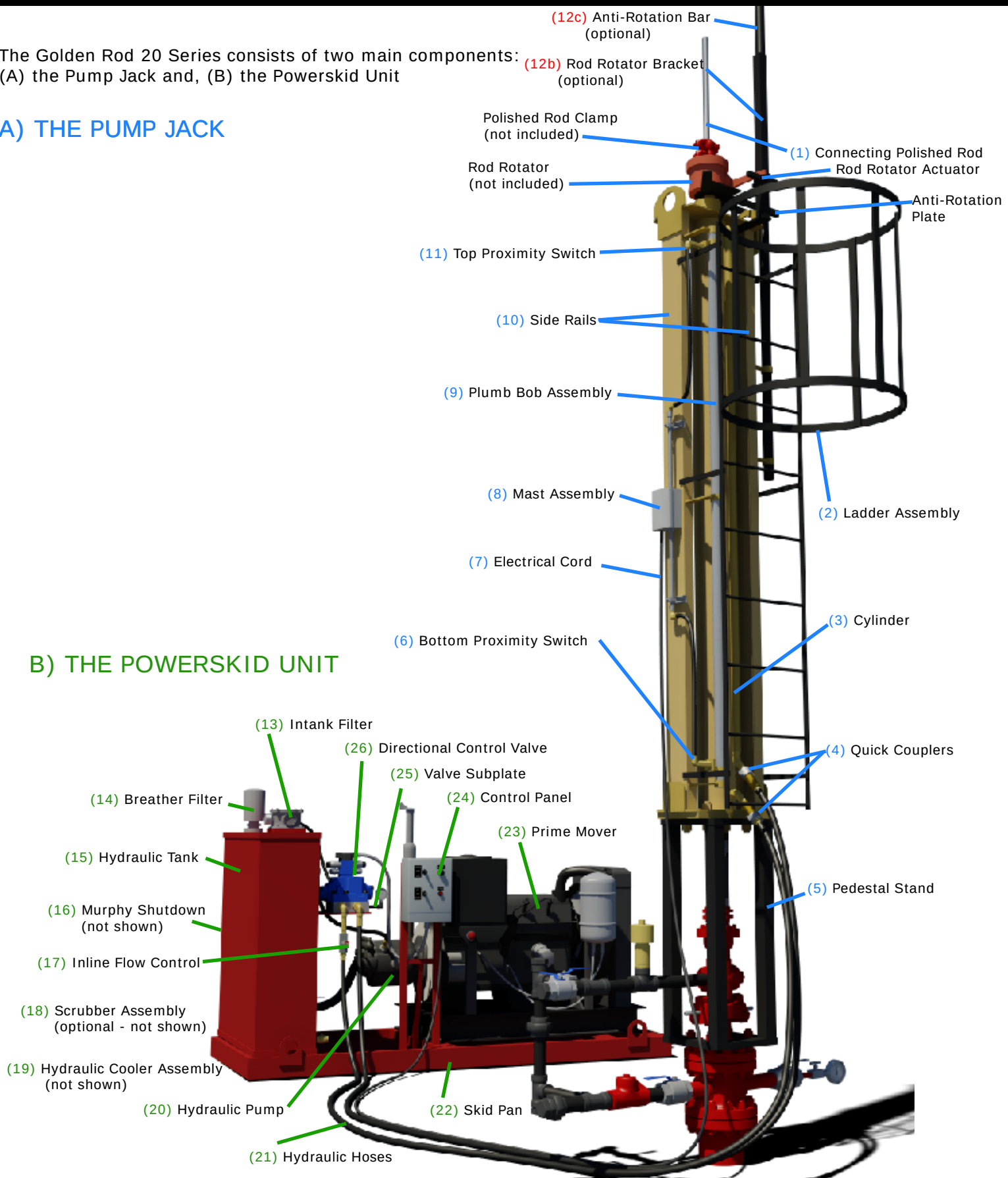
A) THE PUMP JACK

B) THE POWERSKID UNIT



The Golden Rod 20 Series consists of two main components:
(A) the Pump Jack and, (B) the Powerskid Unit

A) THE PUMP JACK

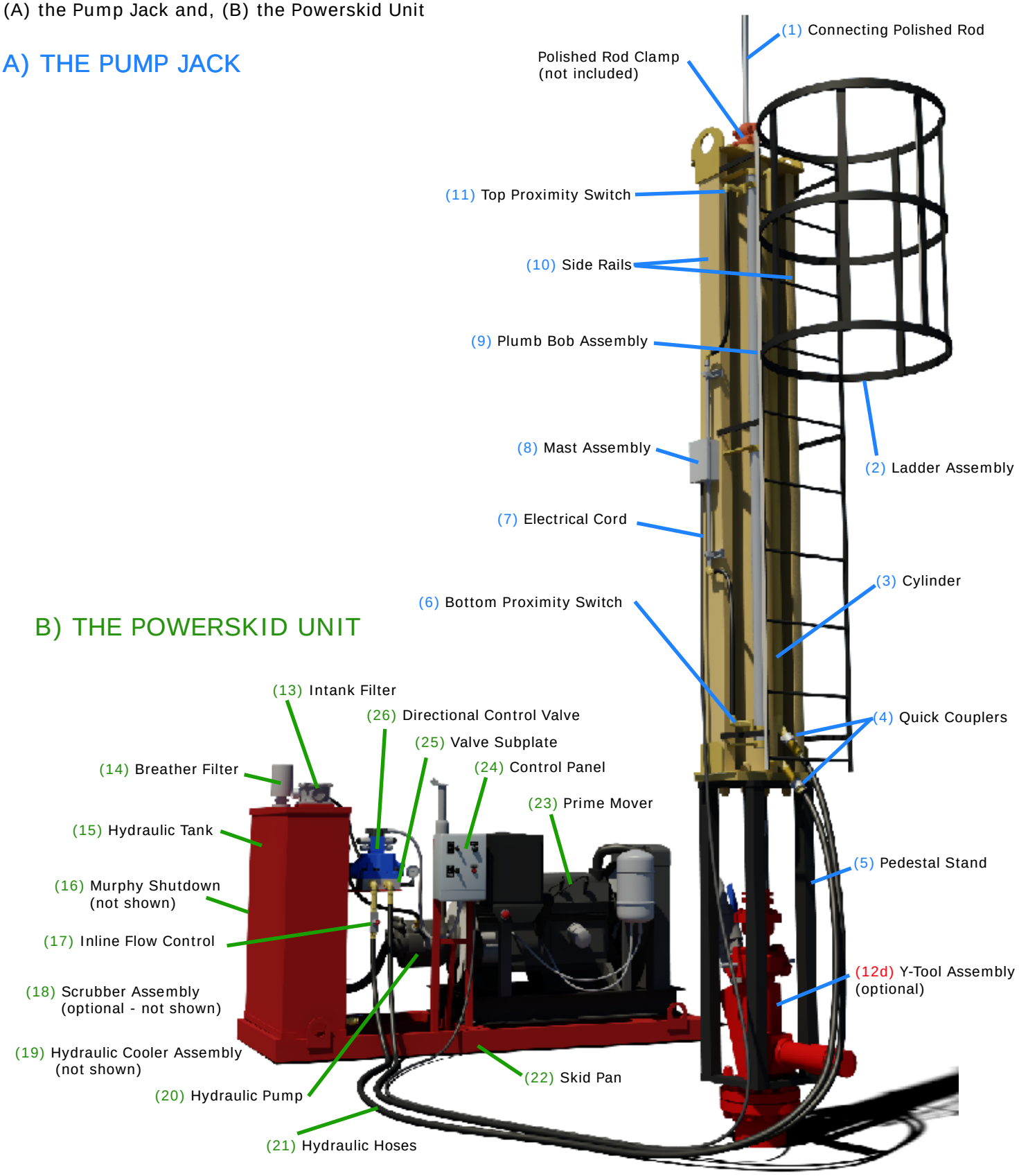


B) THE POWERSKID UNIT

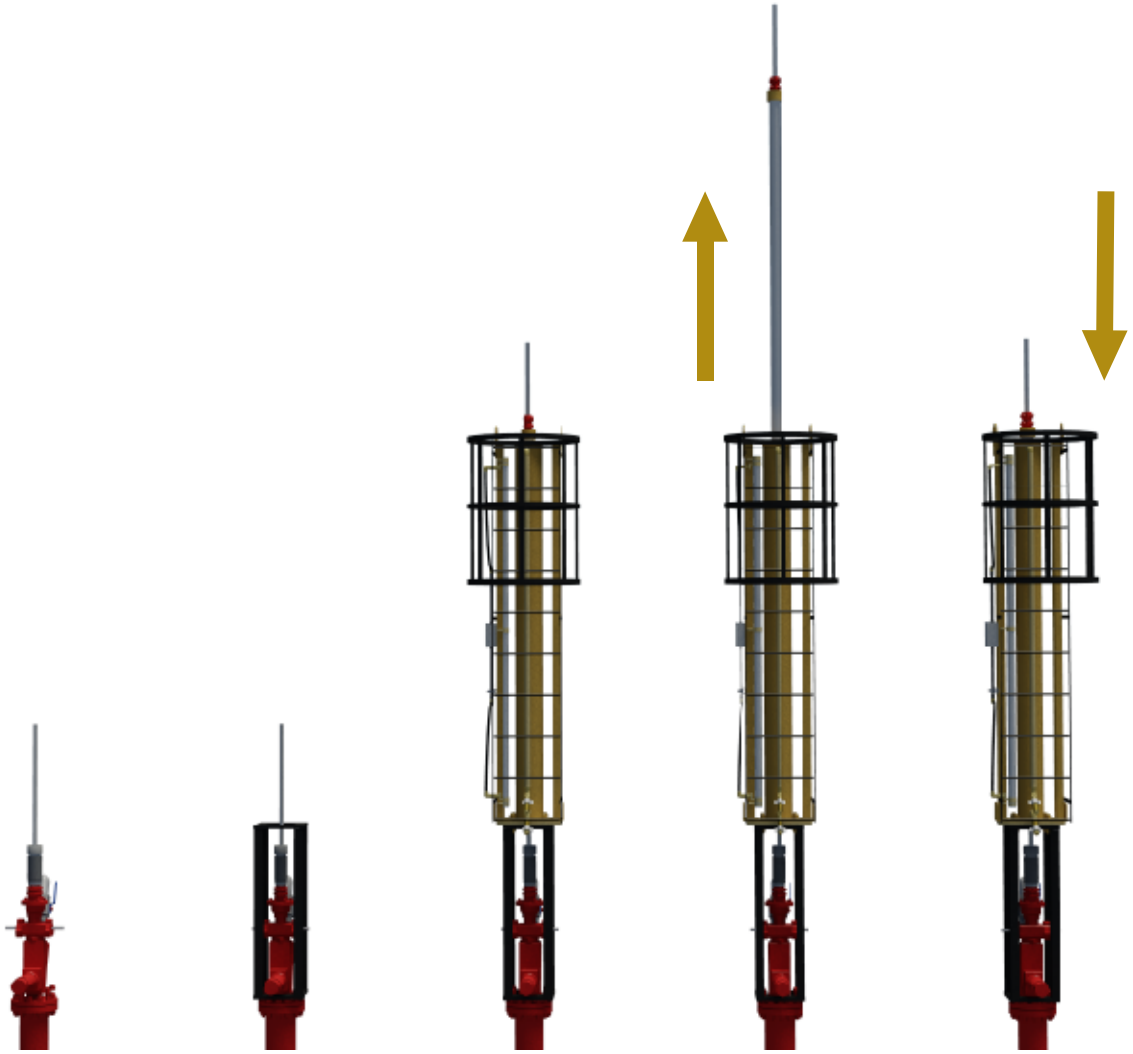
The Golden Rod 30 Series consists of two main components:
(A) the Pump Jack and, (B) the Powerskid Unit

A) THE PUMP JACK

B) THE POWERSKID UNIT



Number	Item	Description	ICI Part Number
Common Pump Jack Components (All Series)			
1	Connecting Polished Rod	Connects the polished rod downhole to the top of the hydraulic cylinder with a standard rod coupling	4801
2	Ladder Assembly	Allows for safe climbing of the pumpjack	2800
3	Cylinder	A patented hydraulic cylinder that provides the reciprocating action to work a downhole pump	1000
4	Quick Couplers	Allows for a quick means to connect/disconnect the hydraulic lines between the pumpjack and the powerskid unit	2904
5	Pedestal Stand	Used as a means to bolt the pumpjack directly to the wellhead	4500
6	Bottom Proximity Switch	Reads the location of a traveling plumb bob to tell the pumpjack when to switch from the downstroke to the upstroke	2600
7	Electrical Cord	A detachable 13 meter cord that connects the control panel on the powerskid unit to the proximity switches on the pumpjack	2250
8	Mast Assembly	A CSA approved Class 1, Div 2 means of housing electrical junctions on the pumpjack	2200
9	Plumb Bob Assembly	Contains a plumb bob that travels with the cylinder triggering the proximity switches	2300
10	Side Rails	Used on both sides of the pumpjack to house the pumpjack components	2020
11	Top Proximity Switch	Reads the location of the traveling plumb bob to tell the pumpjack when to switch from the upstroke to the downstroke	2601
Unique Pump Jack Components			
12a	Yoke Frame	A unique stand utilized mostly with the Copperhead series to allow the jack to mount to the top of the flow T.	4591
12b	Rod Rotator Bracket	An optional component used to mount a common rod rotator	4000
12c	Anti-Rotation Bar	Used with a the Copperhead and Golden Rod 20 Series to ensure the cylinder does not turn with the rods	4006
12d	Y-Tool Assembly	An optional component used in heavy oil applications that provides surface level coil tubing access to the production string, without the removal of any equipment	10200
12e	ICI Stuffing Box	An optional heavy duty stuffing box	10100
Common Powerskid Components			
13	In Tank Filter	Filters the oil in the hydraulic tank	8060
14	Breather Filter	Filters the air that is drawn into the hydraulic tank	8050
15	Hydraulic Tank	Houses the hydraulic oil that is used to power the pumpjack	6720
16	Low Oil Murphy Shutdown	A low oil shutdown that will shut down the prime mover if the hydraulic oil falls below a pre-set level	7200
17	Scrubber	An optional component on gas engines that allows the engine to run off of casing gas (removes the liquids from casing gas)	9000
18	Hydraulic Cooler	A radiator, controlled by a thermal bypass, used to cool the hydraulic oil	6800
19	In Line Flow Control	A flow control valve that can be used to slow the return of oil from the bottom of the cylinder to the tank, thus controlling the downstroke speed	3010
20	Hydraulic Pump	An open loop pump which supplies pressurized hydraulic fluid to the hydraulic system	6000
21	Hydraulic Hoses	High pressure hydraulic hoses used to convey fluid from the powerskid unit to the pumpjack	6600
22	Enviro Skid Pan	An environmentally friendly skid pan used to house the powerskid unit components	7500
23	Primemover	A natural gas, diesel or electric motor used to power the hydraulic pump	5000
24	Control Panel Assembly	A CSA approved electronic control system used to start, stop and control the pumpjack	3000
25	Directional Control Valve	A valve that switches between ports, changing the flow of hydraulic fluid	3003
26	Valve Subplate	The connecting ports beneath the directional control valve used to connect the valve to the rest of the hydraulic system	3021



*shown with GR-30 Series

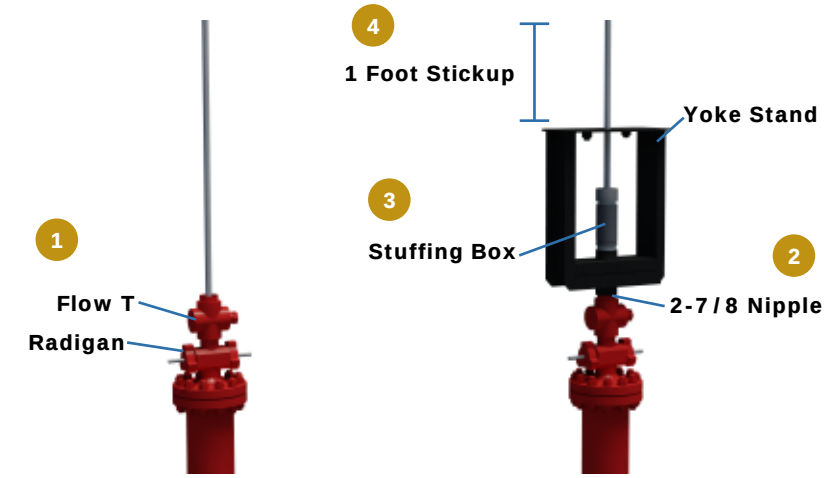
Setup:

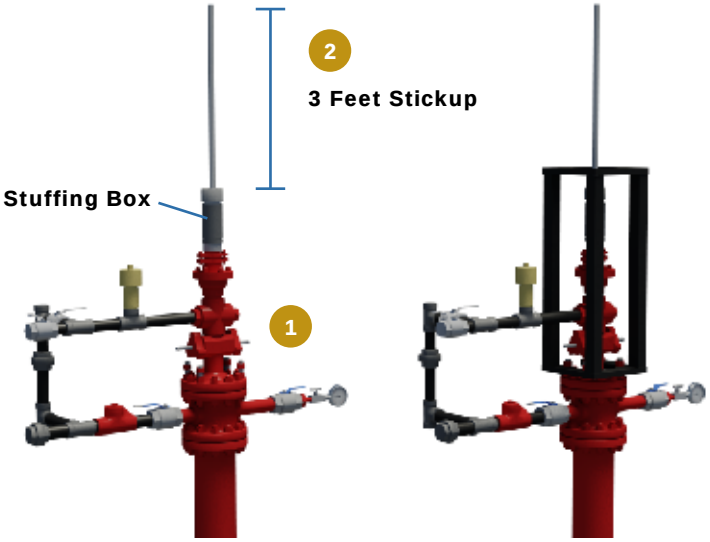
1) The downhole pump and rods are run into the well and clamped off on the stuffing box at surface.
2) The pedestal stand is bolted directly to the wellhead.
3) The pumpjack bolts to the pedestal stand.
4) The top of the rod string is connected to the bottom of the connecting rod with a rod box.
5) The top of the connecting rod is attached to the top of the pumpjack with a rod clamp.

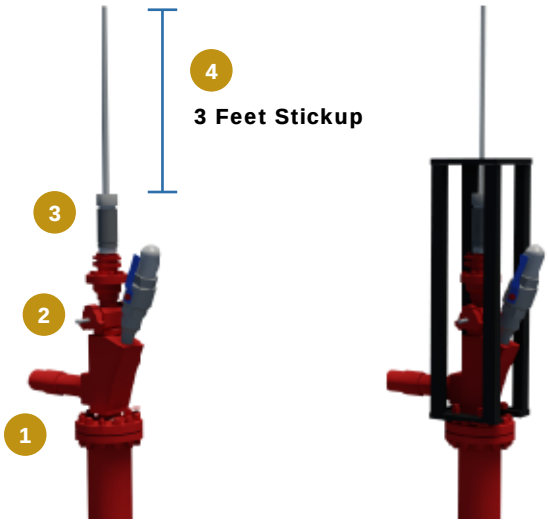
Operation:

6) The gas, diesel or electric prime mover powers the hydraulic pump providing fluid power to the hydraulic valve and the rest of the system.
7) As hydraulic fluid is pumped into the bottom inlet of the pumpjack, it pushes the internal piston in an upward direction.
8) As the piston extends upwards, it lifts the attached rod string and the plumb bob until the plumb bob comes into contact with the top proximity switch.
9) When the top switch is triggered, it sends an electronic signal to the hydraulic valve telling it to change direction. Fluid exits the bottom of the pumpjack and is allowed to flow into the top inlet, allowing the piston (and rod string) to fall. This starts the downstroke.
9) As the piston moves downwards, so too does the rod string and the plumb bob until the bottom switch is triggered, again reversing the direction.
10) Repeated up and down motion of the piston between the proximity switches, imparts an up and down motion on the rod string, creating the reciprocating action necessary to work the downhole pump.

8.1) Service Rig Instructions







The Copperhead 10 Series

The Copperhead Series uses a "Yoke Stand" to bolt the pumpjack directly to the Flow T, providing a universal means to bolt to any wellhead. Installation with a pedestal stand is also possible (see below) and this stand can be used to mount the GR-20 Series.

1) Install the Radigans and Flow T as usual
2) Attach a 2-7/8 EUE nipple between the top of the Flow T and the Yoke Stand (the threads on the Yoke Stand are 2-7/8. For 2-3/8 wellheads, swedge up to 2-7/8)
3) Attach the stuffing box inside of the Yoke Frame
4) Leave one foot polished rod stickup above the top of the stand
5) Clamp off on the stuffing box

NOTE:
A) The Yoke Stand must be installed with the service rig, prior to reassembly of the wellhead.
B) Polished Rod must not exceed 1-1/4" with this series
C) Please report Polished Rod Size and pin to an ICI representative prior to installation of the pumpjack.

The Golden Rod 20 Series

The Golden Rod 20 Series pedestal stand bolts directly onto the tubing bonnet flange. The standard pedestal stand is 50 inches in height and will bolt directly to 7-1/16", 2000lb or 3000lb flanges. Custom stands can be built for specialized wellheads (i.e. dual completion, composite wellheads, sour gas wellheads, 5000lb wellheads etc.)

1) Turn Radigans in-line with the flow line
2) Leave 3 feet of polished rod stickup above the stuffing box
3) Clamp off on the stuffing box

NOTE:
A) Please report the size of the tubing bonnet flange to an ICI representative prior to installation of the pumpjack (i.e.7-1/16, 2000lb)
B) Please report Polished Rod Size and pin to an ICI representative prior to installation of the pumpjack.

The Golden Rod 30 Series

The Golden Rod 30 Series has an optional Y-Tool wellhead assembly. If utilizing a standard wellhead, see Golden Rod 20 instructions above.

1) Bolt the Y-Tool Assembly directly to the wellhead flange
2) Install the radigan on top of the Y-tool, perpendicular to the Flow Line
3) install the stuffing box above the radigan
4) Leave 3 feet of polished rod stickup above the stuffing box
5) Clamp off on the stuffing box

NOTE:
A) Please report the size of the wellhead flange to an ICI representative prior to installation of the pumpjack.
B) Please report Polished Rod Size and pin to an ICI representative prior to installation of the pumpjack.

Step 1: Prepare Wellhead

1a) To ensure a timely installation at minimal cost, the wellhead should be prepared prior to ICI's arrival on the lease (See Wellhead Setup - Page 8).

1b) Thread a Rod Coupling to the Polished Rod Stickup matching the pin size of the Connecting Rod

Step 2: Install the Stand

Golden Rod Series:
2a) Remove 4 studs from the tubing bonnet flange and replace with long studs (replace with 10" studs on a standard 2000lb wellhead and 12" studs on a standard 3000lb wellhead).
2b) Secure the wellhead with "2H" nuts on the top and bottom of the wellhead.
2c) Position the Pedestal Stand on top of the nuts on the tubing bonnet flange with the long stud protruding through the stand.
2d) Secure the Pedestal Stand with 4 "2H" nuts.

Copperhead Series:
2e) Stand should be installed according to Wellhead Setup instructions (page 8)

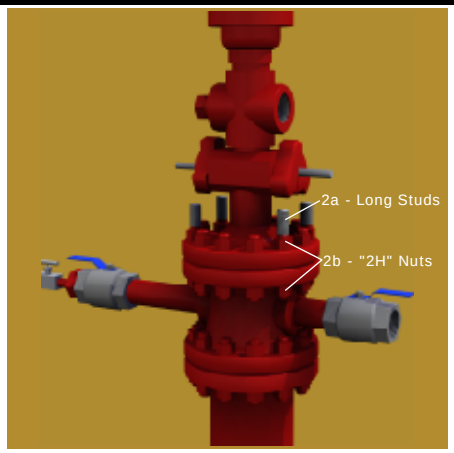
Step 3: Prepare Pump Jack on Ground

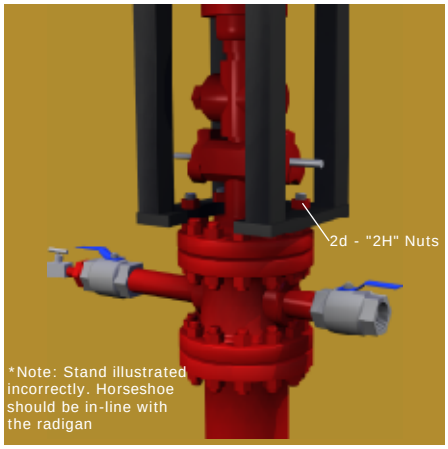
3a) Ensure Plumb Bob can move freely within the PVC Pipe (during shipping, the Plumb Bob is secured to the bottom bracket housing the PVC pipe. Loosen off the 3/8 bolt.
3b) Insert Connecting Rod in the top of the jack
3c) Assemble Rod Rotator System (optional)
3c.1) Install Rod Rotator Bracket on the top plate of the cylinder using the provided 1" bolt
3c.2) Position Plumb Bob Bracket so that the Plumb Bob is aligned with the PVC pipe.
3c.3) Install Anti Rotation Bar into the brackets on the side rail.

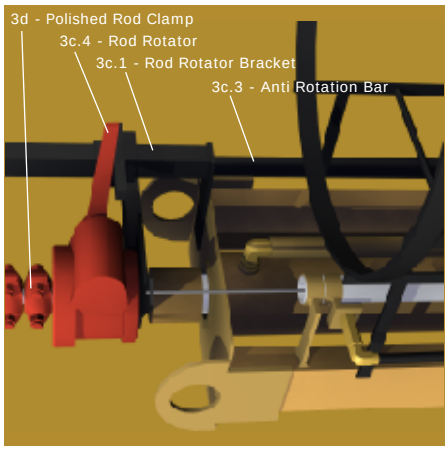
Warning: Ensure this bar is held tightly in place to prevent slippage during installation.

Note: At this stage, install Anti Rotation Bar to the height of the pump jack only. The bar will be moved into its fully extended position once the pump jack is installed

3c.4) Position Rod Rotator so that the arm of the Rod Rotator will come into contact with the arm of the Rod Rotator Bracket.
3d) Install Polished Rod Clamp on top of the cylinder
3e) Install Pony Rod or Polished Rod Coupling on the top of the Connecting Rod.







Step 4: Install Cylinder on Pedestal Stand

4a) Thread 2 Clevis Fasterners and 10ft Slings into the eyeholes on the top of the Pump Jack. (Cleavis Fasterners should have a minimum lift rating of 1 Tonne. The Slings should have a minimum rating of 10,000lbs).
4b) Protect the threads on the bottom of the jack by moving the nuts so that they are flush with the end of the bolts (A piece of wood can also be placed underneath the bolts for added protection).
4c) Lift the Pump Jack into place above the Pedestal Stand.
4d) Secure in Place using 4 "2H" nuts.

Step 5: Tighten Connecting Polished Rod

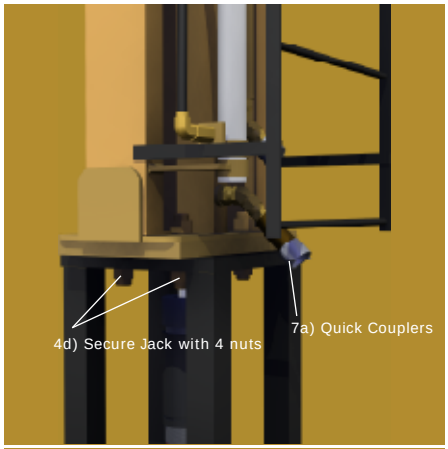
5a) Prevent Polished Rod stickup from turning using a pipe wrench on the Polished Rod Clamp (Warning: Do not place wrench on the Polished Rod itself).
5b) Thread Connecting Rod into Rod Coupling on the Polished Rod. Stickup. Tighten Securely (You may need to loosen the top Polished Rod Clamp to let the Connecting Rod fall to the Coupling).
5c) Tighten top Polished Rod Clamp.

Step 6: Connect Electrical Cord

6a) Connect 13 Meter Electrical Cord to the bottom of the Control Panel on the Powerskid Unit (ensure this cord is not beneath hydraulic hoses).

Step 7: Connect Hydraulic Hoses

7a) Connect Hydraulic Hoses from the Powerskid Unit to the Pump Jack. Thread Quick Couplers to the line indicator on the coupler (You should be able to do this by hand. Do not use a wrench).



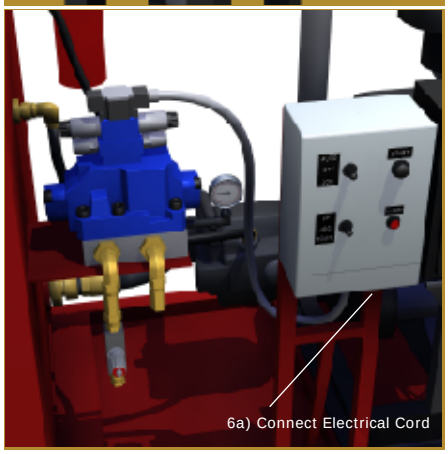
Note: Ensure quick couplers are free of any dirt/debris to aviod contamination of the hydraulic system.

Step 8: Remove Bottom Polished Rod Clamp

8a) Start Engine.
8b) On the Control Panel, switch to Manual Mode (Hand/Jog).
8c) Jog up 4" above the stuffing box.

Warning: Do not try this in Auto Mode. Be very careful not to ram the Polished Rod Clamp into the bottom of the cylinder.

8d) Check to ensure top clamp is holding. The bottom clamp should not slide back down to the stuffing box.
8e) Check alignment of polished rod through center of cylinder. Shim between pedestal stand and the wellhead nuts as necessary to correct wellhead misalignment.
8f) If no slippage is observed, remove Bottom Polished Rod Clamp.

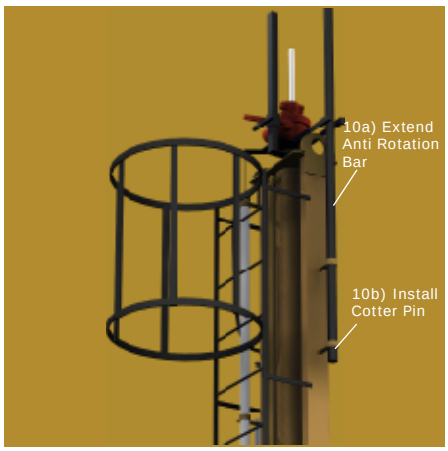


Step 9: Make Required Adjustments

9a) Set Stroke Length (detailed on Page 13).
9b) Correct Pressure Setting if necessary (detailed on Page 14).
9c) Set Rod Rotator bracket so the Rod Rotator arm is triggered without passing the arm on the bracket.

Step 10: Extend Anti Rotation Bar

10a) Extend Anti Rotation Bar so that the pole is nearly flush with the bottom bracket.
10b) Install the Cotter Pin through the Anti Rotation bar so that it rests on the bottom Bracket.



11.1) Control of the Pump Jack

The Control Panel is used to control the startup, shutdown and movement of the Pump Jack. Each Control Panel has 3 main modes of operation:

1) Auto Mode ("Auto")
In Auto mode the unit will cycle automatically between the proximity switches.

2) Off Mode ("Off")
In Off Mode the primemover may continue to run, but the Pump Jack will stop and/or will not function.

3) Manual Mode ("Hand/Jog")
In Manual Mode the unit will override the proximity switches and high pressure shutdown.

Warning: The High Pressure shutdown is disabled in Manual Mode. Be careful not to overpressurize the flowline operating the jack in Manual.

In Auto Mode, press the start button to start the Pump Jack. The Pump Jack will continue its cycle automatically.
In Manual Mode, the Pump jack can be moved up and down incrementally using the Hand/Jog toggle switch.

Warning: When the start button is pressed in Auto mode, the Pump Jack will always travel upwards first. Therefore, always ensure the Plumb Bob is below the Top Proximity switch before pressing the start button.

If the Plumb Bob is above the Top Proximity switch:

1) Switch to Manual Mode
2) Jog downward until the Plumb Bob is clearly below the Top Proximity Switch
3) Switch to Auto Mode
4) Press the Start Button

12.1) Start Up

Step 1) Open Bypass Valve (shown on Page 17)

Step 2) Start Prime Mover

With Electric Prime Movers, switch Breaker in the Starter to "On" and toggle to "Auto". Check motor rotation (should be right hand or turning clockwise when facing the motor fan). With Gas Prime Movers, hold in Murphy Switch while pressing the Start Button on the Engine (or while turning the key on some

Step 3) Set RPM (gas, diesel engnes only)

Turn Throttle Control counterclockwise to increase RPM (clockwise if using electronic governer).

Warning: Do not exceed 1800 RPM on the prime mover or you will damage the hydraulic pump.

Step 4) Circulate Hydraulic Oil (as necessary).

Warning: On all cold startups, circulate system to heat hydraulic oil, prior to activating the Pump Jack. Sending cold oil to the cylinder will damage the internal seals.

Warning: On all cold startups, destroke the hydraulic pump to start system slowly (i.e. 1 - 2 SPM)

Warning: On all new startups, circulate hydraulic oil to purge air from the system, prior to activating the Pump Jack. Having air in the hydraulic system will damage the internal seals.

To circulate hydraulic oil:

a) Join the two hydraulic hoses on the Powerskid Unit together
b) Close By-Pass Valve (shown on Page 17)
c) Switch the Control Panel to Auto Mode and press Auto Start
d) Circulate oil for 15 minutes on new startups and 45 minutes on cold startups.

Step 5) Close By-Pass Valve

Step 6) Ensure Plumb Bob is below the Top Proximity Switch (if not, switch to Manual and jog down).

Step 7) Switch Control Panel to "Auto"

Step 8) Press Start

12.2) Shut down

Step 1) On the Control Panel, switch to Manual Mode and jog down until cylinder is fully retracted

Note: Cylinder should be fully retracted daily to prevent rust buildup. When stopping the unit for extended periods and during takedown, shipping and storage, always ensure the cylinder is fully retracted.

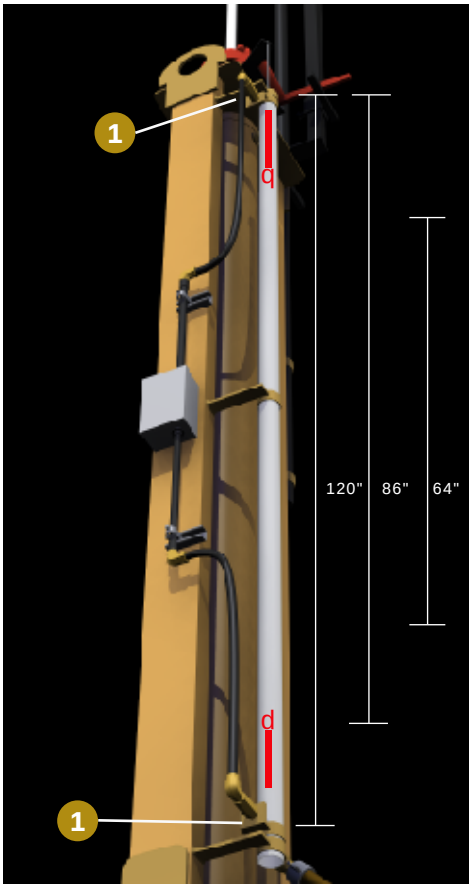
Step 2) On the Control Panel, switch to "Off"

Step 3) Open By-Pass Valve

Note: During takedown, shipping or storage of the unit, ensure Quick Couplers are properly covered to prevent build up of dirt and debris.

13.1) Stroke Length Change

Since the Proximity Switches determine when the Pump Jack changes from the upstroke to the downstroke and vice versa, the distance between the switches determines the surface stroke length. Moving the switches farther apart increases the stroke length. Moving them closer together decreases the stroke length.



Setting the Stroke Length:

1) Determine desired stroke length
2) Loosen 3/8" bolt on the Proximity Switch Bracket (1) and adjust Proximity Switch by:

A) Moving the Bottom Proximity Switch up or down
B) Moving the Top Proximity Switch up or down

To adjust the Top Proximity Switch position without climbing the ladder, loosen the bolt holding the PVC pipe and lower the entire pipe.

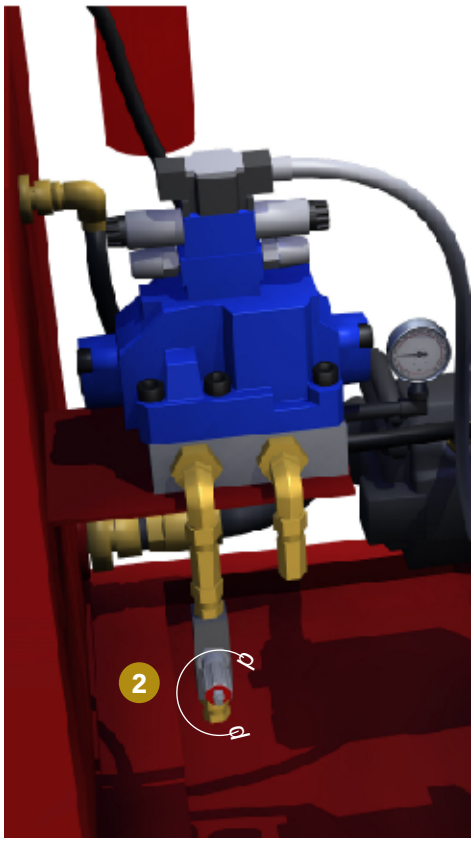
Warning: Cylinder should never be allowed to bottom out on the downstroke or top out on the upstroke. Use caution when moving the proximity switches to the ends of travel.

13.2) Stroke Speed Change - Downstroke Speed

The downstroke speed is controlled by the Inline Flow Control Valve (2). This valve limits the speed at which oil can exit the bottom of the cylinder.

A) To increase the downstroke speed - Turn knob counter-clockwise

B) To decrease the downstroke speed - Turn knob clockwise



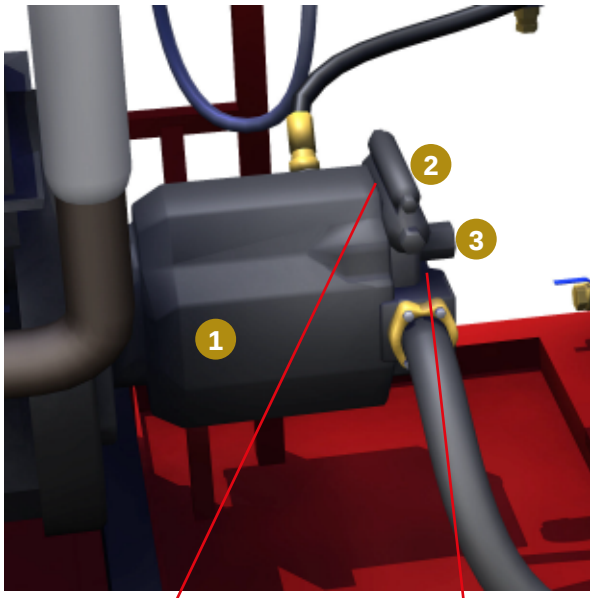
Note: Downstroke speed should not exceed 3 Feet per second or 2 times the up speed (i.e. if the upstroke speed is 10 seconds, the downstroke speed should not exceed 5 seconds). Excessive speed may cavitate the seals.

14.1) Stroke Speed Change - Upstroke Speed

The upstroke speed is determined by the flow of oil generated by the hydraulic pump (1) - the greater the flow, the faster the upstroke speed. The hydraulic flow is controlled by the Maximum Volume Stop (3). Turn Max Volume Stop out for faster upstroke speed and in for slower upstroke speed.

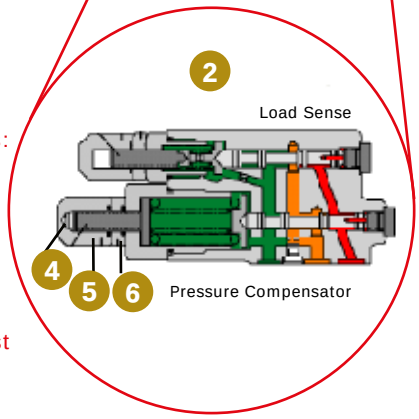
The hydraulic pressure determines the maximum the system can lift. The Pressure is controlled by the Pressure Compensator (2) and the Pressure Relief Valve (7).

Warning: Consult an ICI representative PRIOR to making any pressure adjustments. INCORRECT ADJUSTMENT CAN SEVERELY DAMAGE SURFACE AND DOWNHOLE COMPONENTS. CALL (780) 872-7470.



To Increase the Pressure:
1) Stop the Cylinder and open Bypass Valve.
2) Disconnect bottom hydraulic line on cylinder.
3) Turn in pressure relief adjustment (7) clockwise to safety stop.
4) Close Bypass. Pressure gauge (8) should read 200 - 300 psi. This is the load sense setting. Switch to Auto and press start. Pressure will build in the system. Check pressure gauge. This is the current compensator pressure setting.
5) Remove Cap Nut (5) with a 17mm (11/16") wrench.
6) Loosen Lock Nut (6) with a 17mm wrench.
7) Using a 3mm allen wrench turn adjustment screw (4) until desired pressure is attained (turn clockwise to increase pressure).
8) Retighten lock nut and caps.

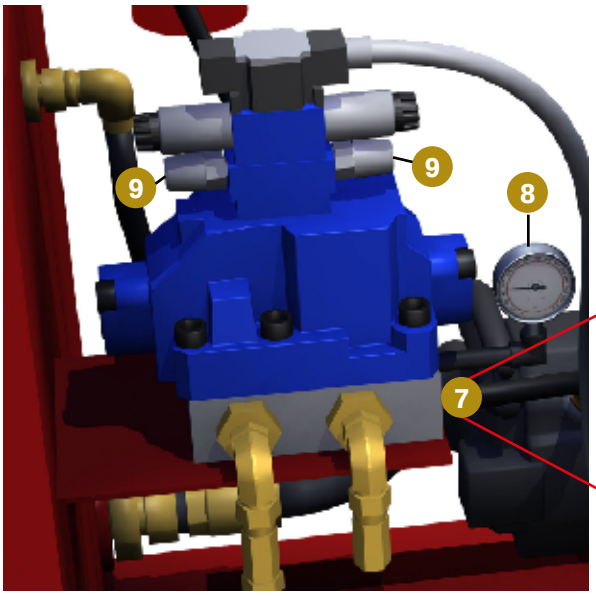
Reset Pressure Relief
9) Switch Control Panel to "Off".
10) Open Bypass.
11) Reconnect hydraulic line.
12) Restart the Well.
13) On upstroke, back out Pressure Relief until cracking pressure (you will hear hydraulic oil bypassing at the Relief Valve).
14) Turn Relief Valve 1/2 to 3/4 turn clockwise.
15) Tighten lock nut.

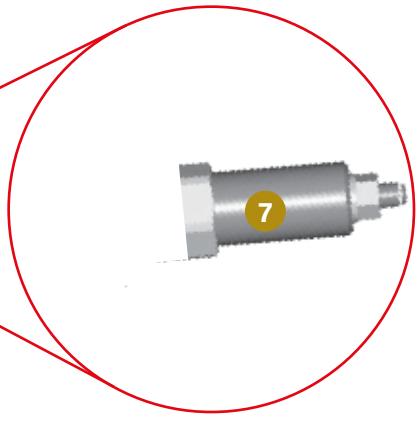


Pressures are factory pre-set as follows:

The Copperhead 10 Series - 1000 psi
The Golden Rod 20 Series - 1800 psi
The Golden Rod 30 Series - 2100 psi
The Golden Rod 40 Series - 1200 psi

It is strongly recommended that these pressures are not exceeded without first consulting with an ICI representative!





If the system does not shift smoothly after a speed adjustment change, the Valve Chokes (9) will need to be readjusted to reduce the shock in the system. Remove protective caps and thread adjustments OUT for faster shifting and IN to slow or smooth out the shifting.

15.1) Maintenance Instructions - Gas Engines - 3L, 4.3L and 5.7L GM Powertrain Engines

15.1 A) ENGINE OIL RECOMMENDATIONS

1) Use only engine oil that meets GM Standard GM6094M and displays the American Petroleum Institute (API) Starburst certification mark "FOR GASOLINE ENGINES" on the container and has a low ash content.

2) **DO NOT USE** synthetic or diesel motor oils

15.1 B) ENGINE OIL SELECTION

AMBIENT TEMPERATURE	ENGINE OIL TYPE
- 18 degrees C (0 degrees F) and above	SAE 10W-30
Below -18 degrees C (0 degrees F)	SAE 5W-30

15.1 C) COOLING SYSTEM

The coolant should give freezing protection to -32 degrees C and boiling protection to 125 degrees C. Add or refill the engine cooling system using only a permanent-type coolant. Use a mix of 50% ethylene glycol and 50% clean softened water up to a maximum of 60% ethylene glycol and 40% clean softened water. Refer to the mixture chart on the container for additional antifreeze protection information. Do not use alcohol or methanol antifreeze or mix them with the specified coolant.

15.1 D) FUEL SYSTEM

Fuel source lines should have 2.5 oz pressure coming into the engine if running off of propane, and 5 oz pressure if running off of casing gas. Do not use fuel sources that are > 20 ppm sour.

15.1 E) GAUGE READINGS

1) Oil Pressure Gauge - Oil pressure should be greater than 20 psi.
2) DC Volt/Amperage Gauge - Should read 2 amps or greater depending on battery requirement and no less than 13.5 VDC
3) Coolant Temperature Gauge - Should read no greater than 220 degrees F
4) Manifold Vacuum Gauge - Engine life is extended if Vacuum Gauge reading is greater than 3 in. Hg.

15.1 F) ENGINE SERVICE SCHEDULE

OPERATION	Startup Sequence	Daily	Weekly	Every 100 Hr.	Every 200 Hr.	Every 400 Hr.	Every 750 Hr.	As Req.
Check engine oil level	1	X						
Check coolant level	2						X	
Check for fluid leaks	3	X						
Change engine oil and filter (1st @ 200hrs.)							X	
Check battery charge and fluid levels	4	X						
inspect and clean radiator exterior		X						
Clean battery cables								X
Check belts and belt tension	5						X	
Lubricate throttle, governer and choke linkage							X	
Inspect and clean air cleaner element							X	
Replace primary air cleaner element							X	
Replace safety air cleaner element								X
Replace engine coolant								X
Replace fuel filter								X
Clean, adjust and test spark plugs								X
Replace PCV holes, tubes and fittings							X	
Replace spark plugs								X
Adjust throttle and governer								X
Check all nuts and bolts for tightness	6							X
Drain Fuel Gas Scrubber		X						

16.1) Maintenance Instructions - Hydraulic System

16.1 A) HYDRAULIC OIL RECOMMENDATIONS

1) Use only hydraulic oil desgined for high pressure hydraulic requirements for reciprocating gear, piston and vane pumps and heavy duty industrial hydraulic systems.

2) Hydraulic oil should meet and exceed the manufacturers requirements for Vickers, Denison, Cincinnati Milacron, Rexroth and Sundstrand pumps.

16.2 B) TYPICAL PROPERTIES

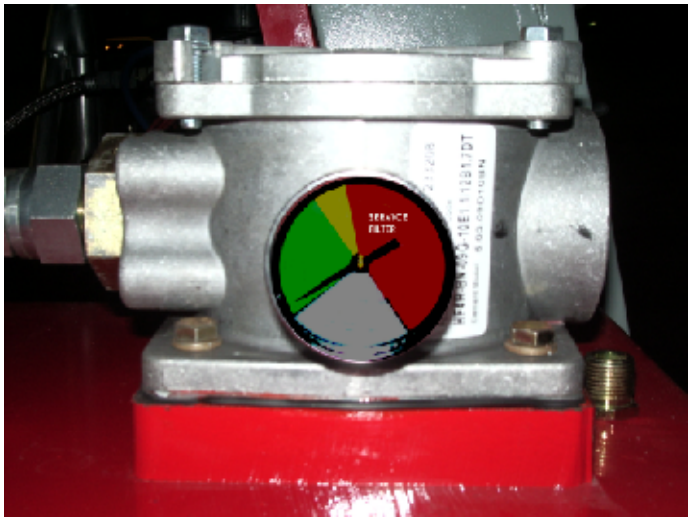
Density (D1296) @ 15 degrees C, Kg/l	0.870
Viscosity (D445), cSt @ 40 degrees C	35.7
Viscosity (D445), cSt @ 100 degrees C	7.08
Brookfield Viscosity, cp @ -30 degrees C	6550
Brookfield Viscosity, cp @ - 40 degrees C	32200
Viscosity Index	164
Flash Point (D92), degrees C	155
Pour Point (D97), degrees C	-48
ASTM Oxidation Test Hours	2000+
Antiwear Additive	Present
Foam Test (D892)	Pass
Demulsibiity Test (D1401)	Pass
Color	Clear
OPERATING TEMPERATURE RANGES (degrees C)	-10 to 70
Without Warm Up	-30 to 70
With Warm Up	

16.3 C) HYDRAULIC OIL MAINTENANCE

1) Continually monitor oil filter gauge to ensure system remains free of contaminants. As needle moves into the yellow zone, the filter will require changing.

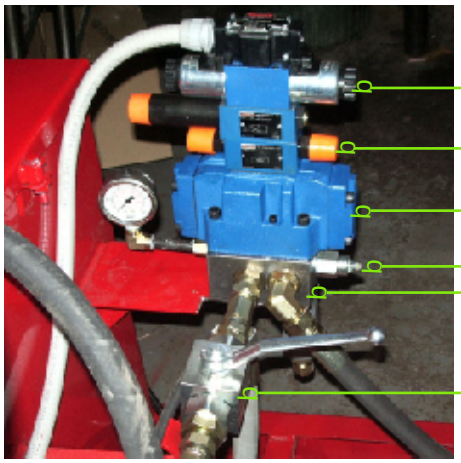
2) Change Intank Hydraulic Filter every 4320 hours (approximately every 6 months).

3) To maximize equipment lifetime, collect and test oil samples on a yearly basis. Filter/replace oil as required.



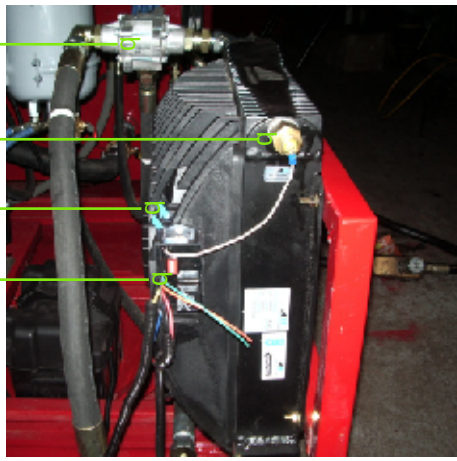
DETAILED PARTS ASSEMBLIES

A) HYDRAULIC VALVE STACK ASSEMBLY



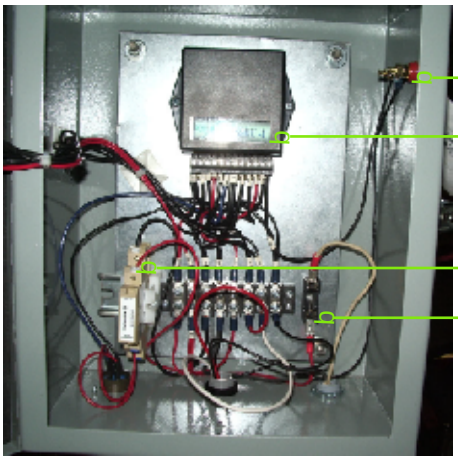
- 12 Volt Coils
- Chokes
- Directional Control Hydraulic Valve
- Pressure Relief Valve
- Valve Subplate
- By-pass Valve

B) COOLER ASSEMBLY



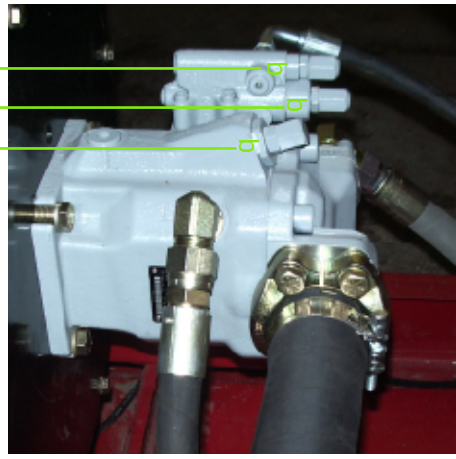
- Thermal By-pass
- Temperature Switch
- Hydraulic Cooler
- Temperature Control Relay

C) CONTROL PANEL ASSEMBLY



- Presco Terminals
- SSRU-2 Relay
- Barrier
- Control Panel Fuse

D) HYDRAULIC PUMP ASSEMBLY



- Load Sense Control
- Pressure Compensator
- Speed Control

17.1) Common Replacement Parts

Category	ICI #	Item	Description
Mast Assembly	2200	Mast Assembly	CSA Approved Class 1 Div 2 Junction Box and Conduit
13m Cord	2250	13m Electrical Cord	13m Cord with Control Panel Connection
Plumb Bob Assembly	2300	Complete Plumb Bob Assembly	Including plumb bob, airplane wire, bracket
Switching Assembly	2600	Proximity Switches	CSA Proximity Switch
Switching Assembly	2620	Conduit Adaptors	CSA Adapter
Jack Fittings and Hoses	2906	Female Quick Coupler	#16 Parker Connect under Pressure Couplings Wing Nut
Control Panel Assembly	3002	SSRU-2 Relay	Relay for Control Box
Control Panel Assembly	3003	Directional Control Valve - lg	Directional Control Valve, NS25 Pilot Operated
Control Panel Assembly	3004	Directional Control Valve - sm	Directional Control valve
Control Panel Assembly	3010	In-Line Flow Control - lg	Inline Flow Control Valve - lg
Control Panel Assembly	3011	In-Line Flow Control - sm	Inline Flow Control Valve - sm
Control Panel Assembly	3020	Valve Subplate - lg	Subplate Steel, D08, w Sun T-3A Relief cavity
Control Panel Assembly	3021	Valve Subplate - sm	DD07SPRVS12S SUBPLATE
Control Panel Assembly	3005	Relief Cartridge	Relief Valve Cartridge
Rod Rotator System	4000	Complete Rod Rotator Brackets	Complete Rod Rotator Bracket
Regen Kit	4700	Regen Kit Assembly	Regen Circuit for Increased SPM
Hydraulic System	6700	36 W Hydraulic Oil	36W Hydraulic Oil
Contamination Kit	7500	Hydraulic Oil Contamination Kit	Hydraulic Oil Contamination Kit
Hydraulic Cooler	6801	12V Hydraulic Cooler	ASA 0176 12VDC; 0.22kW; 26 bar (370psi)
Hydraulic Cooler	6802	460V Hydraulic Cooler	ASA 0176 460VDC; 0.25kW; 26 bar (370psi)
Hydraulic Cooler	6803	Thermal Bypass Valve	Parker , #16 NPT Inlet, Bypass Valve
Hydraulic Cooler	6804	Temperature Switch 12V	Relay & Sensor for 12V Cooler
Hydraulic Cooler	6805	Temperature Switch 460V	ASA ILLZTH6065 TEMP SWITCH
Engine Add ons	7020	Battery	Utility Battery
Engine Add ons	7021	Battery Box w/ Lid	Box for Battery
Filters & Gaskets			
Filter 3.0	8010	Engine Oil Filter for 3.0L	Engine Oil Filter for 3.0L
Filter 4.3	8020	Engine Oil Filter for 4.3.L	Engine Oil Filter for 4.3L
Filter 5.7	8030	Engine Oil Filter for 5.7L	Engine Oil Filter for 5.7L
Filter Cummins	8040	Engine Oil Filter forCummins	Engine Oil Filter for Cummins
Oil Pan Gasket	8041	Gasket for Cummins Oil Pan	Gasket for Cummins Oil Pan
Filter Breather	8050	Breather Filter	Hydraulic Tank Breather Filter
INTANK FILTER	8060	Intank Filter, Complete Assembly,	FILTER ASSEMBLY
Filter Intank Element	8061	Intank Filter Element	Hydraulic Intank Filter
Intank Filter Gasket	8062	Intank Filter Gasket	Gasket for Intank Filter
Intank Filter O-ring	8063	Intank Filter O-Ring	AS-251 NBR 90 O-RING
Clogging Indicator	8064	Clogging Indicator	Pressure Gauge Clogging Indicator 0-30 psi
Filter Luberfiner	8070	Luberfiner Filter	Luberfiner Filter
Natural Gas Scrubber	9000	Natural Gas Scrubber	Complete Scrubber
Household Regulator	9010	Household Regulator	1" NPT, 1/4" 6-8" w/c MAX IN 175psi, OUT 25
Fisher Regulator	9020	Fisher Regulator	1" 627 Fisher Regulator, 5-20 psi
POP Valve	9030	1" E/1 Taylor - T-8200	Pop Valve for Scrubber
5000 psi pressure gage	9040	2-1/2" faced - 5000# pressure gauge	5000# pressure gauge
Stuffing Box	10100	1-1/4" Stuffing Box	1-1/4" Stuffing Box
Stuffing Box Packing	10110	Packing for stuffing box	PACKING-STUFFING BOX-FLD-SL

19.1) UNIT SPECIFICATIONS

Model	CH-10 Series	GR-20 Series *		GR-30 Series ***
Variable Stroke Length	0-64"	0-120"	0-144"	0-120"
Shipping Weight	600 lbs	1,050 lbs	1,200 lbs	1,280 lbs
Vertical Unit Height	7'	11'9"	13'9"	11'9"
Typical Lift	14,000 lbs	20,000 lbs	20,000 lbs	40,000 lbs
Maximum Lift	18,000 lbs	30,000 lbs	30,000 lbs	40,000 lbs
Prime Mover Power Source	Propane/Natural Gas/Electric	Propane/Natural Gas/Electric		Propane/Natural Gas/Electric
Installation Equipment Required	1-Tonne Picker	1-Tonne Picker		1-Tonne Picker
Installation Times				
Vertical Well Slant Well	1-3 hours 2-4 hours	1-3 hours 2-4 hours		1-3 hours 2-4 hours
Maximum Strokes Per Minute	5	5.5	6 **	4
Maximum Strokes Per Minute with Regen Kit ****	7.5	8	7	n/a

* ICI has also manufactured custom 36" and 86" units

** 6 SPM requires a 140cc hydraulic pump

*** ICI has also manufactured a GR-40 Series capable of a 65,000 lb lift

**** An "Intensifier Unit" can also be used to increase SPM

Problem 1: Engine is running. Pumpjack seems to be stuck in the upstroke or downstroke

Probable Cause	Solution
1) Pumpjack missed the switch	1) Identify Cause
A) Alternator or battery is failing	A) Test voltage of alternator. Alternator should run at 14.2V. At least 13.5V is required to ensure proper switching. Alternatively, boost the battery and if the jack functions normally when the battery is boosted, then the alternator or battery needs replacing. Check voltage on battery with the engine off to isolate the battery as the problem (if voltage is under 12V, replace the battery).
B) 13 meter cord damaged or disconnected	B) Check to ensure 13 meter cord is connected and not damaged. If a military style connector is used and may have been recently detached/reattached, remove and check to ensure pins have not been damaged. Check to ensure hydraulic hoses are not rubbing on electrical cord.
C) Proximity Switch is loose	C) Ensure Proximity Switch is tight to the PVC pipe.
D) Solid State Relay in Control Panel is failing	D) If no other cause is identified, the Solid State Relay may have failed and needs to be replaced.
2) Plumb Bob is caught	2) Check to ensure Plumb Bob can move freely within the PVC pipe. The Proximity Switch brackets may have been overtightened on a recent stroke length change (trapping the Plumb Bob in the tube).
3) Hydraulic Pump pressure not properly set or the well has become heavier	3) Jog the cylinder downwards to the bottom proximity switch. Press start in Auto Mode and watch the cylinder. If the cylinder moves upwards, slows and stops, the pump pressure may need adjustment. Call and ICI representative to walk you though this process (adjustments detailed on Page 14).
4) Pressure Relief needs adjustment	4) See Stroke Speed Change Section (Page 14). Pressure relief is typically set by finding "cracking pressure", then turning the allen screw in by 1/2 to 3/4 of a turn.
5) Presco Triggered (if Presco is attached to the panel and not the engine)	5) Check to see if the Presco was triggered. Alleviate pressure concern prior to restarting.

Problem 2: In heavy oil application, the Pumpjack seems to be stuck in the upstroke

Probable Cause	Solution
1) Pumpjack missed the switch	1) See Above.
2) Downhole Problems (i.e. Well is sanded in)	2) Switch to Manual Mode on the Control Panel and jog the cylinder down. If the poiished rod separates from the top of the cylinder, or the cylinder will not travel to the bottom switch, downhole problems are likely. On the upstroke, check to see if the speed of the cylinder changes. If the jack slows towards the top of the stroke, or does not reach the top switch, downhole problems are likely.
3) The well is heavier (the pump is compensating)	3) Increase the compensating pressure on the pump. WARNING: SLIGHT PRESSURE CHANGES CAN SIGNIFICANTLY INCREASE LIFT AND CAUSE DAMAGE TO SURFACE OR DOWNHOLE EQUIPMENT. Call and ICI representative to walk you through this process (adjustments detailed on Page 14).

Problem 3: Hydraulic Cooler runs constantly in cold weather or not at all

Probable Cause	Solution
1) Hydraulic oil is hot	1) Check temperature of hydraulic oil (temperature gauge on the hydraulic tank). If temperature is above 140 degrees Fahenheit, the cooler should be running. If the Powerskid Unit is in an enclosure, ensure proper ventilation. Also ensure that the cooler has a fresh source of air and is free from obstructions and debris.
2) Cooler Relay is not properly set	2) Ensure Cooler Relay is set to 3 (140 degrees Fahrenheit)
3) Cooler Relay is damaged	3) Check Cooler Relay by switching the relay to 1. The cooler should kick in. Move the setting up sequentally (2, 3, 4, 5, 6) and note where it stops running. If cooler does not kick in, cooler relay is likely damaged and needs replacing.

Problem 4: Engine is running. Pumpjack will not respond either in Manual or Auto Mode

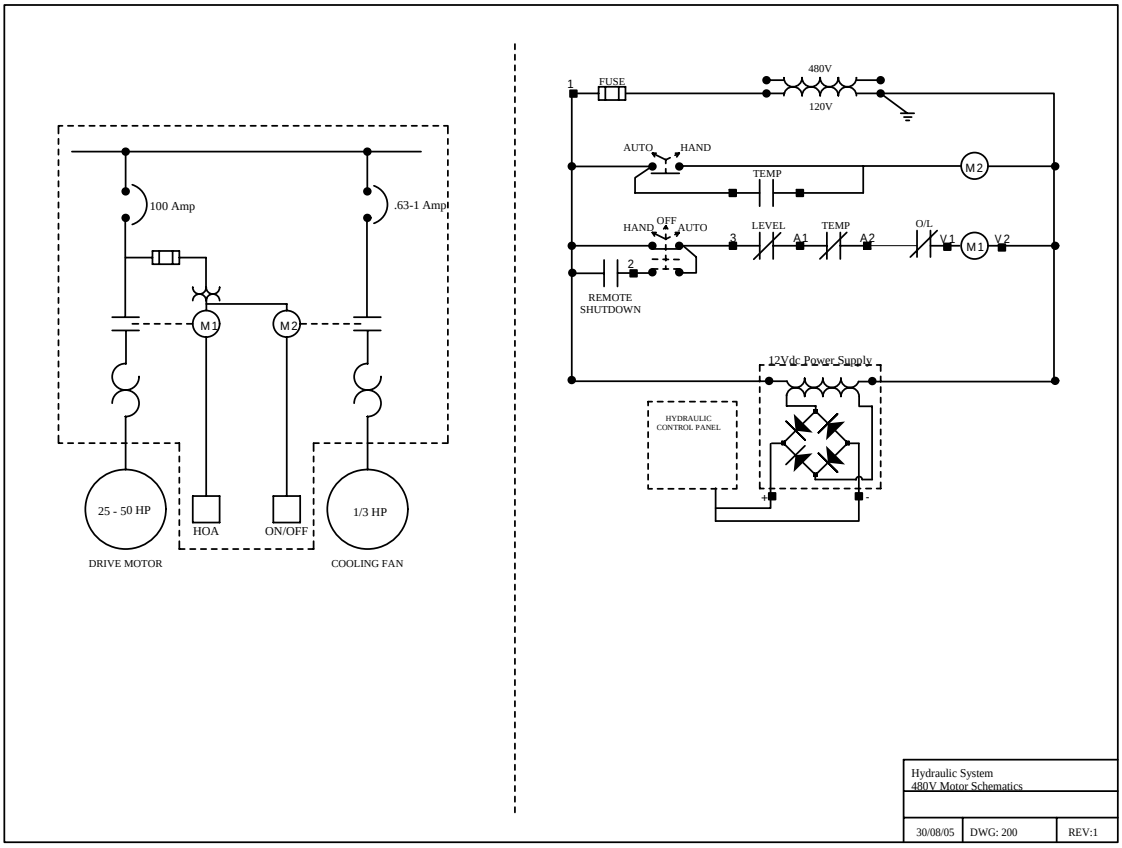
Probable Cause	Solution
1) Bypass Valve is open	1) Close the bypass valve to enable supply of oil to the cylinder
2) No power supply to the panel	2)Trace back power supply to the battery (you can test power supply to the panel by placing a metal object across the Presco connections on the side of the panel. If Presco light illuminates, then there is power to the panel). Ensure electrical cable is tightly secured to the Pumpjack and the control panel. Remove electrical cord at both connection points to ensure pins are not damaged.
3) Quick coupler is not fully engaged	3) Thread together coupler (hand tighten only) until the end of the female wing coupler reaches the marked line on the male coupler.
4) Control Panel fuse is blown	4) Check and repace fuse if damaged.

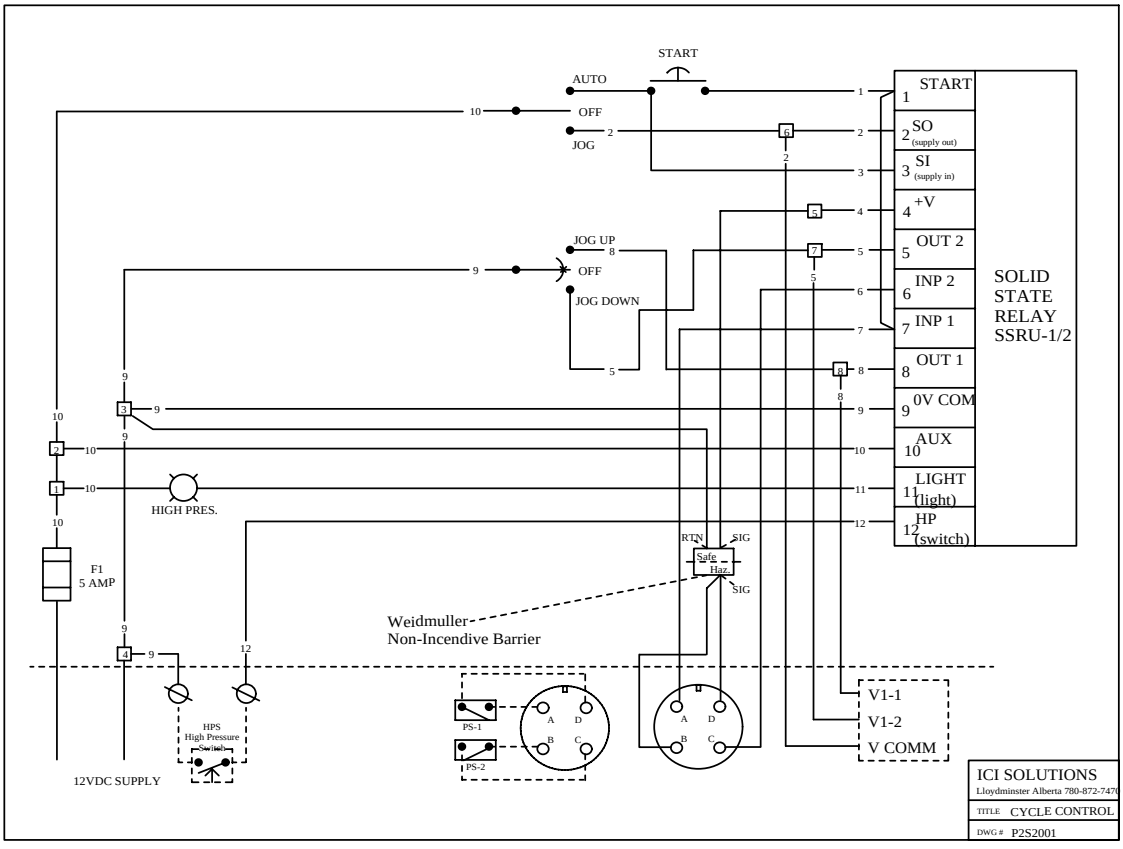
Problem 5: Engine is shutdown

Probable Cause	Solution
1) An engine shutdown switch was triggered	1) Identify which switch was triggered and alleviate problem
A) Presco switch was triggered (only applicable if Presco is wired to the engine)	A) Check flowline pressure and alleviate problem before restarting
B) Low hydraulic oil switch	B) Check hydraulic oil level in the clear tube above the Murphy switch. Fill as required.
C) Engine temperature switch	C) Check for signs of the engine overheating (i.e. coolant spill). Check coolant levels and fill as required.
D) Hydraulic oil temperature shutdown	D) Check to ensure hydraulic cooler is working and is free of debris/obstruction. Where the powerskid unit is in an enclosure, ensure adaquate ventilation. Ideal hydraulic temperature is between 140F and 160F. Check temperature gauge on the hydraulic tank to ensure termperature is in this range.
E) Low engine oil level	E) Check oil level. See if engine will turn over. Cummins engines have a low engine oil level that may be triggered.
2) Power problem	2) Trace back power source from the Control Panel. Check the fuse on the back of the Murphy Tattle-Tale switch on the engine. Replace fuse if necessary (14 Amp).
3) Battery or Alternator has failed	3) Test voltage (see above). Replace failed component.
4) If electronic carburetor, engine may have gone down on overspeed.	4) Weight of the well has changed. Reset electronic carburetor or take the load off the engine by slowing down the hydraulic pump.
5) Fuel gas problems (if running off of casing gas)	5) There may not be enough BTU's in the casing gas. Check for ice plugs in the regulator on the scrubber. Also check for signs of oil in the scrubber. Ensure scrubber has fuel pressure when engine is under demand (needs at least 5 oz pressure).

Warning: NEVER RUN THE PUMPJACK WITH COLD HYDRAULIC OIL. When restarting after an engine shutdown in cold weather, you must circulate the system to heat the hydraulic oil PRIOR to activating the PumpJack (see Circulating Instructions - Page 12).

23.1) Electrical Schematics (Hydraulic Schematics Available Upon Request)





Legal Disclaimer

This manual is intended to give our customers basic information regarding the design, installation and operation of ICI hydraulic jacks and powerskid units. It is not intended to be a complete source of information on these matters. The customer is responsible for using this information in a correct and safe manner. It is recommended that all customers contact an ICI representative for assistance prior to installing, adjusting or operating the equipment.

The operation of any ICI product beyond the parameters outlined in this manual without factory approval may be damaging to the equipment and/or personnel in which case ICI Artificial Lift Inc. and its affiliates cannot accept any responsibility whatsoever and disclaims all liability thereof.

Warranty

ICI Artificial Lift Inc. (ICI) warrants that its products shall, for the period of the Warranty Term, be free of any defect in material and workmanship and that it will perform in accordance with specifications. The Warranty Term shall be a three (3) months from the date of purchase of ICI products unless otherwise stated in writing.

The sole obligation of this warranty shall be to either repair, or at ICI's option replace, the product, at no charge. Proof of purchase must be supplied for warranty repair.

There are no warranties except as stated. There are no warranties expressed or implied, including, but not limited to, the implied warranties of merchantability and of fitness for a particular purpose. In no event shall ICI be liable for consequential, incidental, or special damages, including, but not limited to, loss of production, profits or goodwill.

Products which have been subject to abuse, misuse, vandalism, accident, alteration, neglect, modifications, improper installation, unauthorized repair, or usage not in accordance with product specifications and instructions will not be covered by warranty.

Only hardware manufactured by ICI is covered by the standard warranty. Additional item such as pumps and controls, if defective, may be repaired or replaced at ICI's discretion.

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